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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/717,487	11/21/2003	Tokihiro Nishihara	025720-00017	7624

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EXAMINER

SUMMONS, BARBARA

ART UNIT PAPER NUMBER

2817

DATE MAILED: 03/08/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	Application No.	Applicant(s)	
	10/717,487	NISHIHARA ET AL.	
	Examiner	Art Unit	
	Barbara Summons	2817	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-18 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-18 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 21 November 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                        | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)               | Paper No(s)/Mail Date. ____.  |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>11/21/03</u> .  | 6) <input type="checkbox"/> Other: ____.                                    |

## DETAILED ACTION

### *Claim Rejections - 35 USC § 102*

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. § 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1-4, 7, 8 and 10 are rejected under 35 U.S.C. § 102(b) as being anticipated by Shibata et al. JP 2002-217676.

Regarding claims 1, 4 and 8, Fig. 7 of Shibata et al. discloses a ladder filter element comprising a plurality of resonators that are arranged in series arms (12 and 14) and parallel arms (16), at least one of the series arm resonators at the first stage on the signal input side (18) including a plurality of single-terminal pair piezoelectric thin film resonators (12a and 12b) connected in parallel. Regarding claims 2 and 3, at least one of the parallel arm resonators (16) includes a plurality of single-terminal pair piezoelectric thin film resonators (16a and 16b) connected in parallel.

Regarding claim 7, as can be seen in the Fig. 5/Fig. 6 embodiment, the split resonators (e.g. 12a and 12b) are of the same size so as to meet the requirement that the radius of the opposing electrodes (r) vs. the thickness of the piezoelectric (t) fulfill the disclosed equation (see e.g. section [0033] of the attached machine translation).

Regarding claim 10, the substrate (30) on which the resonators are formed is Si (see section [0009]), the piezoelectric layers are AlN or ZnO among others (see section [0014]), and the electrodes are gold or copper among others (ibid.)

***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. § 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

4. Claims 12-18 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Shibata et al. JP 2002-217676 in view of Bradley et al. U.S. 6,262,637.

Shibata et al. discloses the invention as discussed above (see e.g. Figs. 7 and 9), except for explicitly disclosing the filters being housed in a package for use as a transmitting/receiving filter in a high-frequency duplexer with amplifiers.

Bradley et al. discloses that it would have been extremely well known in the art to provide thin film piezoelectric resonator filters in packages (not shown see col. 11, lines 46-59) as the transmitting and receiving filters in duplexers utilizing a power amplifier in the transmitting branch and a low noise amplifier in the receiving branch (see Fig. 1).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the filter of Shibata et al. (Figs. 7 and 9)

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by having provided it in a package and used it as the transmitting and receiving filters in a duplexer with amplifiers, because such an obvious modification as packaging is explicitly suggested by Bradley et al. (see col. 11, lines 46-59) and would have provided the advantageous benefits of protection from environmental factors as, as would have been known by one of ordinary skill, and using the filter in duplexers with amplifiers would have merely been an extremely well known intended use of thin film piezoelectric resonator filters as suggested by the exemplary teaching thereof by Bradley et al. (see Fig. 1).

5. Claim 11 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Shibata et al. JP 2002-217676 in view of Tikka et al. U.S. 6,407,649.

Shibata et al. discloses the invention as discussed above, except for explicitly disclosing a film of SiO<sub>2</sub> on the upper electrode of the parallel resonators.

Tikka et al. discloses that it is extremely well known in the thin film piezoelectric resonator art that in ladder filters the parallel resonators have a different resonant frequency from the series resonators, the different frequency being provided by mass loading the parallel resonators by providing a dielectric film of SiO<sub>2</sub> on the upper electrodes thereof (see Fig. 7 and col. 3, lines 62-65 and col. 4, lines 47-49 and 60-63).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the filter of Shibata et al., if even necessary, such that the parallel arm resonators would have had a film of SiO<sub>2</sub> on their top electrodes, because such an obvious modification would have merely been a well

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known manner of providing the different resonant frequencies between the series and parallel resonators in a thin film piezoelectric resonator ladder filter, as would have been known by one of ordinary skill and as explicitly suggested by Tikka et al. '649 (ibid.).

6. Claim 9 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Shibata et al. JP 2002-217676 in view of Tikka et al. U.S. 6,741,145.

Shibata et al. discloses the invention as discussed above, except for disclosing the filter as a ladder filter and not a lattice filter.

Tikka et al. '145 discloses that it is known in the thin film piezoelectric resonator art that what applies to a ladder filter structure also applies to the art recognized alternative lattice filter structure (see Fig. 7A vs. Fig. 7B and Fig. 10 vs. Fig. 11).

Consequently, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the filter of Shibata et al. (Figs. 7 and 9) by having provided the parallel connected resonators in the series and parallel arms of a lattice filter, because such an obvious modification would have been the mere substitution of art recognized alternate filter structures as would have been known by one of ordinary skill and as suggested by the exemplary teaching thereof by Tikka et al. '145 (see Figs. 7A vs. 7B and 10 vs. 11).

7. Claims 5 and 6 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Shibata et al. JP 2002-217676 in view of Satoh et al. U.S. 5,631,612.

Shibata et al. discloses the invention as discussed above, except for disclosing the admittance of the series arm or parallel arm having the multiple resonators

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connected in parallel being the same as the admittance in another of the series arms or parallel arms.

Satoh et al. discloses that when designing ladder filters the admittance  $Y$  of multiple parallel arms are made to be the same (see Figs. 63A-63C), wherein the impedance  $Z$  of the series arms is related to admittance such that the admittance of multiple parallel arms are also the same, such that when resonators are split or combined the total admittance of the parallel arm remains the same (see e.g. Figs. 62A and 62B).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the filter of Shibata et al. (Figs. 7 and 9), if even necessary, such that the admittance of the two series arms in Fig. 7 would have been equal or of the two parallel arms in Fig. 9 would have been equal, because such an obvious modification would have provided good filter characteristics with image impedance matching between ladder filter stages as would have been known by one of ordinary skill and as suggested by Satoh et al. (see e.g. Figs. 62 and 63 and col. 20, lines 22-29), and because Shibata et al. explicitly suggested having more than one ladder filter stage cascaded (see e.g. section [0023]). It should be noted that although Satoh et al. speaks in terms of surface acoustic wave (SAW) resonators, SAW resonators and thin film bulk acoustic resonators (FBARs) are electrical equivalents as would have been known by one of ordinary skill in the art (see other art of record as evidence).

***Conclusion***

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Watanabe JP 2003-332884, published on the same day as Applicants' filing date, discloses a SAW ladder filter having a series arm or a parallel arm with multiple resonators connected in parallel (see e.g. Figs. 5 and 6).

Wadaka et al. U.S. 5,789,845 discloses that SAW resonators and FBARs are electrical equivalents in the acoustic wave filter art (see col. 1, lines 38-41).

Kamachi et al. JP 2003-298392 a packaged thin film resonator ladder filter with a parallel arm (see Fig. 1) having two resonators 211 and 212 connected in parallel (see also Fig. 15).

Beaudin et al. U.S. 6,710,677 discloses a filter which may use SAWs or FBARs that has multiple resonators connected in parallel in series and parallel arms (Fig. 8).

Barber et al. U.S. 6,486,751 discloses a thin film ladder filter with at least one resonator in the series and/or parallel arm made of many constituent resonators connected in parallel (see Fig. 11 and col. 2, lines 5-19, col. 4, lines 13-16 and col. 6, lines 18-23).

Lakin U.S. 5,942,958 discloses a thin film ladder filter (Figs. 3A and 3B) having a parallel arm with two resonators X32A and X32B connected in parallel and a series arm with resonators X33AA and X33AB connected in parallel with resonators X33BA and X33BB.

Solal et al. U.S. 6,344,705 discloses a SAW lattice filter having series and parallel arms that have multiple resonators connected in parallel.



Farkas U.S. 2,452,114 and Storch U.S. 2,980,872 disclose lattice filters formed with piezoelectric crystal resonators and the series and parallel arms each having multiple resonators connected in parallel.

Katsuta JP 2000-077972 discloses a SAW filter with a first series arm having multiple resonators connected in parallel (Fig. 1), and Katsuta et al. JP 11-312951 shows a similar SAW filter with multiple resonators connected in parallel in the first parallel arm (Fig. 1).

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Barbara Summons whose telephone number is (571) 272-1771. The examiner can normally be reached on M-Th, M-Fr.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bob Pascal can be reached on (571) 271-1769. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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March 3, 2005



**BARBARA SUMMONS**  
**PRIMARY EXAMINER**